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1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE 14/05/93		3. REPORT TYPE AND DATES COVERED MONOGRAPH	
4. TITLE AND SUBTITLE OPERATIONAL LESSONS FROM THE DAWN OF AIR POWER				5. FUNDING NUMBERS	
6. AUTHOR(S) MAJ W. BRUCE REMBER, USAF					
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) SCHOOL OF ADVANCED MILITARY STUDIES ATTN: ATZL-SWV FORT LEAVENWORTH, KANSAS 66027-6900 COM (913) 684-3437 DSN 552-3437				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES					
12a. DISTRIBUTION/AVAILABILITY STATEMENT APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED				12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words)  SEE ATTACHED SHEET  <div style="text-align: center;"> </div>					
14. SUBJECT TERMS AIR POWER WORLD WAR I ST. MIHIEL  BILLY MITCHELL AIR CAMPAIGN AVIATION				15. NUMBER OF PAGES 58	
				16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED	18. SECURITY CLASSIFICATION OF THIS PAGE UNCLASSIFIED	19. SECURITY CLASSIFICATION OF ABSTRACT UNCLASSIFIED	20. LIMITATION OF ABSTRACT UNLIMITED		

# **Operational Lessons From the Dawn of Air Power**

**A Monograph  
by**

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**93-31514**



**School of Advanced Military Studies  
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Fort Leavenworth, Kansas**

**Second Term AY 92-93**

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Title of Monograph: Operational Lessons From the Dawn of Air Power


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Accepted this 14th day of May 1993

## ABSTRACT

OPERATIONAL LESSONS FROM THE DAWN OF AIR POWER by MAJ W. Bruce  
Rember, USAF. 58 pages.

This monograph examines the development of air combat employment concepts during World War I. From austere beginnings, air power developed rapidly through the four years of war, evolving from a support service for tactical ground units to a cohesive combat force capable of independent action. Literature on World War I aviation focuses either on tactical aspects of the war, especially dramatic accounts of the aces, or the roots of strategic bombing concepts, championed in the 1920s. Often overlooked is the operational level of war, where air and ground forces synchronize their actions to accomplish a theater commander's objectives.

The lessons of air power at the operational level of war concern two primary missions: air control and interdiction. Combat experiences in World War I demonstrated these missions were not effective when organized and commanded by tactical ground units; rather, theater command and control was required in order to establish the priorities required to achieve mass and unity of effort. This lesson was evident by the last year of the war, demonstrated by Colonel Billy Mitchell's air plan in support of the St. Mihiel offensive. Comparison with classical theories provides solid support for these views on air power.

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- Table of Contents

	Page
I. Introduction . . . . .	1
II. Development of Air Concepts 1914-1917 . . . . .	8
III. 1918 and the American Contribution . . . . .	21
IV. Air Power Lessons and Classical Theories . . . . .	29
V. Conclusion . . . . .	38
 Appendix:	
Colonel Billy Mitchell's Air Plan for St. Mihiel . . . .	42
Endnotes . . . . .	44
Bibliography . . . . .	55

## SECTION I: INTRODUCTION

Eddie Rickenbacker, Oswald Boelke, the Red Baron, Billy Bishop . . . this far from complete list of World War I fighter aces still evokes images of modern day knights dueling over the skies of Europe. Revulsion from the butchery of trench warfare and the public's fascination with aviation combined to elevate these and other aces to the status of folk heroes with their own associated mythology. Not even the carnage of aerial conquest dampened this popular support:

even though men died in the sky, often incinerated in their flaming planes, and even though civilians died on the ground in aerial bombardment, somehow the public perceived air war as purer than ground war. The aviators were "freed from much of the ruck and reek of war by their easy poise above it," . . . . Their behavior recalled days when battle was valorous and chivalric.<sup>1</sup>

The public saw aviators as "gentleman warriors" who "were exemplars of the heroic tradition" rather than "pioneers of a new kind of war." To many a belief in air power was an article of faith. To others it was simply a welcome distraction from the horrible carnage on the ground. In both cases, however, air power assumed a life of its own, separate and distinct from the horrors of the battlefield.

This glamorization of air power unfortunately hindered serious study and understanding of how aviation could best contribute to winning a war, whether independently or in concert with other military forces. Traditional military thought further frustrated the effective use of aviation. Just four years prior to the Great War, Generalissimo Ferdinand Foch felt "the airplane is all right for sport, but for war it is useless." As Foch came to "dominate

the councils of both France and the Allies, his emphasis on personnel rather than materiel helped determine the character of the armies that fought in World War I." Even General John J. Pershing, Commander of the American Expeditionary Force (AEF), minimized the role of aviation in his post-war report, failing "to speculate on the mission of aviation" or "appraise the role of aerial warfare."

Despite the popular myths of aces fighting their own private war and various misleading reports by ground commanders which ignored the air war, air power played an integral part in the overall war. Statistics provide some insight to the true scope of aviation in the Great War. Over 55,000 aircrew were killed. The Germans lost over 27,637 aircraft, the British 35,973, and the French 52,640.<sup>8</sup> Without adding the losses of other belligerents such as Italy, Russia, and America, this totals well over 100,000 aircraft destroyed. Far from a being a sideshow, "aviation evolved from an oddity to a military necessity . . . . In the areas of doctrine, tactics, organization, and weapons development, the First World War established the patterns for future development."

Along with the first large-scale use of air power, this war tested and refined the elemental concepts of air power in the crucible of actual combat. In this environment, even the most parochial individuals could be open to new ideas, especially ones that worked. Thus, World War I provides an excellent opportunity for serious study of the contribution of air power to the art of war. While some may argue that today's technology has eclipsed any possible lessons on air power from the Great War, "almost every

basic tactical and strategic application for air power had been tried out, at least experimentally, by the end of the 1914-18 War."<sup>4</sup> Even the advent of nuclear weapons, the technological fulfillment of air theorists such as Giulio Douhet, has not invalidated the basic air power lessons of the First World War. Today's war fighting doctrine, while allowing for the possible use of nuclear weapons, contemplates war primarily relying on conventional weapons. At that level, today's weapons are but refinements to those of 1918.

At the beginning of Air Power, noted aviation historian Robin Higham highlights the obstacles to a clear understanding of air power's contribution to the art of war:

The history of air power has been much confused, both by the glamour surrounding flight and by a lack of historical perspective on the part of its exponents. To pierce this confusion, we must examine the context in which the aeroplane first flew.'

Even better than Higham's suggestion is to examine the context in which aeroplanes first fought. While several small conflicts saw a limited use of aviation prior to 1914, it was during the First World War that aviation first saw large scale employment. Thus, that war provides an appropriate starting point for distilling principles that may serve as guidelines for the operational employment of air power.

World War I represents the culmination of changes in warfare that began in the early 1800s. Napoleon's armies embodied the idea of a nation at war, galvanizing soldiers and civilians to fight for an idea. This prompted Clausewitz's theoretical analysis of absolute war in which national survival provided the impetus to drive



wars to unlimited levels of violence.<sup>10</sup>

Yet the full impact of the industrial revolution did not significantly impact Napoleon's battles. The main object of war was still basically to defeat an enemy's army on a tactical field of battle through a combination of maneuver and firepower. However, by the time of the American Civil War and the Franco-Prussian War, several fruits of the industrial revolution had begun to change the face of war. Railroads permitted relatively rapid transport of troops following mobilization and allowed responsive shifting of reserve forces during battle. Increases in firepower lethality extended the range of rifles and artillery, unmercifully punishing tacticians who kept troop formations densely packed in the face of hostile fire. The telegraph allowed national command authorities to influence and respond to events on the battlefield. As a result, the battlefield expanded in space and time; the increased resilience of a nation's armed forces diminished the strategic importance of any one tactical level victory.

By the turn of the century, Jean de Bloch extrapolated the consequences of these trends, concluding "war has become impossible alike from a military, economic, and political point of view," reasoning that increased battlefield lethality would ultimately force a stalemate "accompanied by entire dislocation of all industry and severing of all the sources of supply."<sup>11</sup> While de Bloch's ultimate conclusion on the impossibility of war has not come true,<sup>12</sup> his concept of attrition warfare accurately predicted the trench warfare of World War I.

By 1914 the changes in warfare, begun by Napoleon and fueled by the industrial revolution, had truly produced a nation-at-arms. Armies now measured in the millions. Moreover, the distinction between combatant and non-combatant had become blurred, as the soldier firing a weapon on a field of battle was dependent on a complex network of support reaching back over transportation and communication channels all the way to factory workers in his home country. The absence of a uniform did not make the factory worker any less a part of the nation's overall war effort."

Following the failure of Germany's Schlieffen Plan to gain a decisive victory, the war on the Western Front quickly stagnated in trench warfare. While maneuver remained somewhat of an option in other theaters of the war, it was elusive in the west despite successive attempts to restore it through massive artillery bombardments and suicidal infantry attacks against automatic weapons fire. As Bloch predicted, belligerents found other means of carrying the war to their enemies. Germany's unrestricted submarine warfare targeted support shipping just as if it were official naval combatants. Similarly, indiscriminate aerial bombing of population centers by both sides to weaken the morale of enemy civilians" pushed the accepted level of violence near to Clausewitz's theoretical extreme. As a result, national military planners had a new problem. With finite resources, they had to balance the traditional objectives of the ground forces with evolving options of attacking an enemy's population and its industrial and transportation infrastructure. Itself a product of the industrial revolution, the

airplane landed directly in the middle of this balancing act.

Not surprisingly, planners initially divided aviation into two main areas: strategic and tactical. The latter category provided direct support to the ground forces and included missions such as reconnaissance, artillery spotting, and close support of troops in contact. Strategic aviation, on the other hand, primarily focused on bombing lines of communications and commercial centers deep in the enemy rear area. In the words of Edgar Gorrell, Chief of the Technical Section, Air Service, AEF:

An army may be compared to a drill. The point of the drill must be strong and must stand up and bear the brunt of the much strong work with which it comes into contact; but unless the shank of the drill is strong and continually reinforcing the point, the drill will break . . . . The object of strategical bombing is to drop aerial bombs upon the commercial centers and lines of communications in such quantities as will wreck the points aimed at and cut off the necessary supplies without which the armies in the field cannot exist."

Many targets, however, failed to fit neatly into either category. For instance, enemy airfields only indirectly affected the army, yet provided a key vulnerability for gaining control of the air. Similarly, rail centers just behind the front lines are a subset of lines of communications, but are typically referred to as tactical targets because of their proximity to the front. In reality, aviation attacked a continuum of targets from the front through the depth of the battlefield and lines of communication all the way to and including the enemy's industrial and civil infrastructure. Notwithstanding the minor bomb damage resulting from most of these raids, they represented a revolutionary approach to waging war. Not confined to lines on a map, the aviator quickly developed a theater

perspective of war,<sup>16</sup> seeking to directly exploit enemy rear area vulnerabilities and achieve victory in a shorter time and at a lower cost in lives.

Unfortunately, almost seventy-five years after the Armistice ending World War I, many soldiers and airmen still have conceptually divergent views on the employment of air power in a theater of war. In the past, success in joint warfighting organizations has often been the result of the personalities involved, but will be more difficult to achieve in the future as budget cuts fuel service parochialism. Successful joint warfighting in the future demands a clear understanding of air power's contribution to the art of war, especially at the theater or operational level. Toward that end, this monograph will examine the lessons of air power employment in World War I, concentrating on those particular lessons that occur at the operational level of war.

The first section will briefly trace the development of air power concepts and doctrine through the years 1914-1917, highlighting specific campaigns or events which illustrate significant lessons for today. The next section will focus on the fighting in 1918, using the American experience during the St. Mihiel offensive to illustrate a successful example of the integration of air power into a theater operation. The third section synthesizes the lessons learned, validating them against the classical military theories of Clausewitz, Jomini and Sun Tzu. Finally, the concluding section adapts these lessons to the current debate over service roles and missions.

## SECTION II: DEVELOPMENT OF AIR CONCEPTS 1914-1917

### The "Cavalry of the Clouds"

The potential of aircraft to open up a third dimension in warfare was revolutionary; however, the actual development of air employment concepts and doctrine throughout World War I followed an evolutionary path. Recognizing an inherent tension between established doctrines and new technologies, historian I.B. Holley warns that "to introduce radical changes in the doctrines of warfare is to run headlong into the opposition of the entrenched interests."<sup>17</sup> Despite notions that "the air was a new element with unknown dangers and unknown rules" so that "past history did not apply,"<sup>18</sup> military leaders organized for combat in accordance with time-honored traditions of land and sea services. Thus, initial warfighting organizations for the developing air forces imitated existing army organizations "because adaptable manuals exist[ed]" and "service aviation was originally manned by men who saw it only as another branch of their own service."<sup>19</sup>

Indeed, prior to World War I the military looked upon aviation as essentially an extension of the cavalry.<sup>20</sup> After the early clashes of the war, though,

cavalry had been virtually shot out of existence . . . and with the nullification of that once-haughty arm the traditional eyes of the army were blinded. But if horsepower on the ground could not prevail, horsepower with wings could; it was the airplane . . . that gave the infantry and the artillery back their sight.<sup>21</sup>

Consequently, flying units had the primary mission of reconnaissance, and as a cavalry of the air, were "equally distributed to ground commanders."<sup>22</sup>

### Reconnaissance and Control of the Air

The value of aerial reconnaissance was not lost on either side, so both were quick to take active and passive measures to minimize their vulnerabilities to prying eyes from the air. Passive measures included use of camouflage, smoke, decoys, and favorable environmental conditions to mask troop movements and force dispositions. Despite these precautions,

the airplane . . . inspired an unholy dread [as] nothing was safe from its merciless gaze . . . Commanders on both sides reached the inescapable conclusion: To observe is to annihilate; to attack is to defend. The cry went up to somehow cleanse the skies of the Argus-eyed machines that were pushing warfare into a new dimension.<sup>23</sup>

Thus evolved an air counter-reconnaissance role<sup>24</sup> for the air service, reinforcing the mind-set of air as an extension of cavalry.

With this new role came new demands on aircraft. A pure observation mission did not necessarily require a fast aircraft, just one that could keep a pilot and observer aloft for several hours. Thus, its payload requirement was simply the aircrew and fuel; subsequent additions of photographic equipment did not substantially increase weight carrying requirements. Even speed was not initially considered essential; on the contrary, some felt that aircraft already exceeded the optimum speed for a person to be able to observe and record the enemy situation below. The introduction of aerial dogfighting changed these requirements. Speed, maximum altitude capabilities, and the ability to carry a heavy machine gun became desired design features in what became known as pursuit aircraft. Rapid advances in aviation technology produced pursuit

aircraft with a decisive advantage over older reconnaissance aircraft; as a result, both sides sought control of the air to achieve freedom of action for reconnaissance and other army support aircraft."

Yet not everyone understood the importance of air control to the accomplishment of other aerial missions. In October 1914 the German High Command stated:

As experience has shown, a true combat in the air as described by journalists and romantics must be considered as sheer mythology. The duty of the aviator is to observe, not to fight, and the French aviators too easily forget that obligation."

This type of attitude was shared by soldiers on both sides who focused purely on tactical priorities within their own sectors, not recognizing the necessity of dominating the battle in the air in order to provide support for the battle on the ground. Because of the unique capabilities of aircraft to rapidly concentrate and move throughout a theater of war, thereby crossing over terrain occupied by many different ground units, the air battle became an operational level problem. Flying units parceled out to divisions and assigned a defensive patrol mission over their division sector could not defend against a concentrated enemy force.

The application of the accepted military principles of offensive action and mass to the battle for control of the air eventually led to the creation of special flying squadrons at army level headquarters. Thus, control of the air became the first aviation task which was independent of tactical level ground units. Attainment of air superiority supported these tactical units by defending against

enemy air incursions and gaining freedom of action for other tactical support aircraft. However, the tactical ground perspective and operational air perspective differed significantly in their approach to gaining control of the air.

The battle of Verdun in 1916 illustrates the different approaches to gaining control of the air. In the spring of 1916, the Germans launched an all out assault against the salient of French forces surrounding Verdun. The initial German approach was defensive in nature and subordinate to tactical ground commander's priorities:

When the Germans began to concentrate for their thrust against Verdun it was natural that they should want to protect this build-up from the camera and eyes of French reconnaissance pilots. The combat area of the German Fifth Army was divided into four "barrage" zones, and small formations of aeroplanes patrolled these zones from dawn to dusk; the pilots were told that French aeroplanes were not to penetrate the barrage . . . . These, indeed, were the tactics of the policeman pounding his beat, and the Germans soon found that the barrage system of defensive patrols absorbed most of their aeroplanes. Although the plan met with some success during the build-up period, it was an immediate failure once the ground fighting began, because the French airmen sought out their enemies and had no difficulty in penetrating the barrage."

"No difficulty" may be overstating the case, as 70 of the 200 French pilots initially sent to Verdun were killed within a month." The Germans had partially reorganized their fighter squadrons to improve responsiveness, but their defensive orientation ensured the air war took place on the German side of the lines. Consequently, the French air service not only flew pursuit aircraft across the lines, but also their slower observation and artillery spotting aircraft."

The commander of the French air service at Verdun, Major du



Peuty, described his initial success in correspondence with Major-General Hugh Trenchard, commanding the Royal Flying Corps (RFC) in France:

The most characteristic facts about the fight so far are, first, the new importance of night reconnaissance, and second, the improvements resulting from organising our fights into separate groups outside the ordinary army co-operation squadrons . . . . Aircraft can be divided into two, army machines and combat machines. And these aircraft can be employed in two separate ways: either by using the combat machines to protect the army machines, or by letting the latter fend for themselves so that the combat machines can do their real job of fighting. We've employed both methods, and here are the results. Like the Germans, we began by adopting the second method, and thanks to our offensive efforts we attained a material and moral superiority so marked that the enemy were forced to protect their army machines."

Thus, by Verdun, all belligerents recognized the need to group aircraft together into separate units in order to be able to apply mass to achieve control of the air. The difference at Verdun between the German approach and the French approach was in the use of aircraft for offensive missions. The initial German defensive orientation, though exacting a heavy price from the French, failed to stop French reconnaissance and artillery spotting missions over the German lines.

Despite its success, the French offensive policy provoked criticism within their own army, as

corps commanders, misunderstanding what was at stake, protested shrilly at being left in the lurch, despite the fact that their corps machines, by flying in formations of three, as ordered, managed to do their work, protect themselves and suffer relatively few casualties in the process."

Responding to the "panic-stricken cry of the beleaguered ground

troops that the only aircraft they ever saw were German,"<sup>22</sup> du Peuty's army superiors directed him to cease offensive action against the German rear and instead shift to defensive flight in direct protection of French artillery and infantry. The Germans, meanwhile, learned from their initial failures by regrouping their aircraft into "strike-units." As the Germans shifted these Fokker squadrons to Verdun from other sectors, they carried the air war to the French rear, "harassing the French ground defenses, bombing rear supply lines . . . and repeatedly inflicting casualties, in passing, on the army co-operation machines."<sup>23</sup> The French reacted by directing even more defensive patrols, until their own "artillery and reconnaissance machines, pinned behind the French lines, were unable to do their work" and their "combat aircraft, held back for tight escort duties, became easy targets for Fokkers." Recognizing their error, du Peuty's superiors relented and allowed him to "hit back with similar ruthlessness until . . . he regained the initiative, never to relinquish it."<sup>24</sup>

Appreciating the theater-wide impact of air power, Trenchard offered more than just moral support to du Peuty's efforts at Verdun. Trenchard not only "ransacked RFC depots for every Lewis gun, tracer bullet and bombsight that could be spared" and sent them to Verdun without being asked, but he also "deliberately increased local pressure on reduced enemy squadrons [in his zone], knowing that du Peuty's air battle was his, too."<sup>25</sup>

Du Peuty's experience at Verdun reinforced Trenchard's unwavering belief in the offense. Trenchard summarized his views in a

memorandum he wrote to General Haig in September 1916:

An aeroplane is an offensive and not a defensive weapon. Owing to the unlimited space in the air, the difficulty one machine has in seeing another, the accidents of wind and cloud, it is impossible for aeroplanes, however skilled and vigilant their pilots, however numerous their formations, to prevent hostile aircraft from crossing the line if they have the initiative and determination to do so."

Thus Trenchard felt "the sound policy would seem to be, if the enemy changes his tactics and pursues a more vigorous offensive, to increase our offensive."<sup>17</sup>

Contemporary observers and historians alike have criticized Trenchard for a mindless offensive attitude which wasted many allied pilots and aircraft. Certainly a gap existed between his theories and actual practice." Part of his difficulty lay in the decentralized structure of his air service prior to 1917. The Germans, in contrast, while tending toward a defensive mindset, did recognize the deficiencies inherent in a decentralized structure. By late 1916 the German's had created specialized fighter, reconnaissance, and bombing squadrons." General Ludendorff created a separate organization for the air force under General Ernst von Hoeppner. General von Hoeppner then organized existing fighter squadrons (lastas) into a wing (jaodgeschwader). This became the famed Flying Circus under Manfred von Richtofen, employed in accordance with "the principles of concentration and economy of force."<sup>18</sup> Trenchard followed the German example, reorganizing into "units with one type of machine" and creating squadrons with specialized roles."

By the end of 1916, then, belligerents had a theater-wide perspective on air control, leading to aerial dogfights of increas-

ing size and intensity. And when pursuit aircraft could achieve at least limited control of the air, other aircraft supported their armies through reconnaissance, artillery spotting, infantry liaison, close attack, and rear area bombing missions. The first four of these missions remained subordinate to ground commanders at corps level and below; however, the responsibility and targeting authority for bombing missions became a matter of increasing controversy. At one extreme, strategic bombing advocates called for strikes directly against enemy population and industrial centers to bypass the stagnated slaughter of the trenches. At the other extreme, army traditionalists felt any effort not directly supporting the tactical ground commander's battle diluted the main effort and wasted precious resources. This resulted in the development of bombing plans along two distinct lines, strategic and tactical.

#### Strategic and Tactical Bombing--Diverging Paths

The impact of strategic bombing in World War I was more moral than material.<sup>42</sup> Despite strategic raids into England with Zeppelin airships and four-engined Gotha bombers, Germany eventually abandoned its strategic air campaign in favor of missions which directly supported tactical ground units. In contrast, and partially in reaction to the initial panic caused by some of the German strategic raids, the British in 1917 created an independent Royal Air Force (RAF) to conduct strategic air attacks directly against the German homeland.

Such attacks were not new however. Since 1914 the Royal Naval Air Service (RNAS) had been conducting long range strikes into

Germany. Initially, these strikes targeted Zeppelin sheds and support facilities; eventually, target lists included German industry, transportation networks, and population centers. Actual damage was minimal because of the limited loads carried, the poor accuracy obtained, and the failure to mass sufficiently against any one target. After the war Giulio Douhet extrapolated data from some of these missions to predict a fearful offensive potential for aircraft in the future, but contemporary observers were much more pragmatic in their analysis of strategic bombing. Of note is Winston Churchill's 1917 commentary:

All attacks on communications or bases should have their relation to the main battle. It is not reasonable to speak of an air offensive as if it were going to finish the war by itself. It is improbable that any terrorization of the civil population which could be achieved by air attack would compel the Government of a great nation to surrender . . . . In our own case, we have seen the combative spirit of the people roused, and not quelled, by the German air raids . . . . Therefore our air offensive should consistently be directed at striking at the bases and communications upon whose structure the fighting power of his armies and his fleets of the sea and of the air depends."

Note that Churchill's dismissal of strategic bombing's potential is based on its psychological impact, not its direct physical impact on an enemy's war making potential. Admittedly, the psychological impact argument was the only feasible one for strategic air power advocates at the time. During World War I, despite some well-developed theories on strategic targeting," technology had not yet provided the equipment for aircraft to physically destroy a nation's war making potential. Thus, World War I does not provide a good test for theories that promote the independent application of air

power. Therefore, this monograph will not investigate potential lessons on the ability of air power to win wars alone through strategic bombing; rather, it will pursue Churchill's line of reasoning and investigate the operational level lessons of air power employment against the bases and communications directly supporting the armed forces of an enemy.

#### Interdiction: Linking Tactical and Strategic Thought

Actually, some bombing missions classified as strategic were against military targets or the infrastructure directly supporting military operations; they were considered strategic primarily because of their distance behind the front lines. Likewise, tactical bombing missions not only included direct bombing of front line enemy troops, but airfields, supply depots, and transportation networks which supported those troops. Today, the deeper tactical missions and military-related strategic missions would all fall under the label of interdiction, conducted primarily at the operational level of war."

The development of bombing pushed aviation into the traditional domain of another army branch: the artillery. As I. B. Holley comments, "by utterly ignoring the factor of range, the statisticians of the General Staff virtually reduced the bomber to a field gun." In contrast to the cavalry, which receives a mission, some viewed the aeroplane as mobile artillery, which simply services targets.

This approach came as a result of problems with the early employment of bombers. The combination of the lack of air control

by either side, which extracted a heavy price on offensive bombing missions, and the small bomb payloads made any massed effects near impossible to achieve. In many cases, only a handful of bombers would even make it to their targets; less would return home."

Further compounding this technical difficulty was the doctrine calling for decentralized organization; aircraft dispersed across the front conducted uncoordinated and thus small raids with little or no effect." An RFC review in the summer of 1915 revealed only three of 141 bombing attacks had been successful. Trenchard responded to this dismal record by calling for more centralized control of bombing missions to prevent a dilution of mass.

The present spasmodic efforts against unsuitable or unimportant objects will be discontinued. Aeroplanes will not be used by Armies in attempts to influence local situations by bombing railway stations and junctions. Sustained attacks with a view to interrupting the enemy's railway communications will be ordered by G.H.Q. in conjunction with the main operations of the Allied Armies. Special squadrons are being trained for this purpose."

By the end of 1915, the RFC had codified this position:

It is now an accepted principle that attacks on all important objectives should be carried out by as many aeroplanes as possible, all the aeroplanes flying together and reaching the objective together."

Change came slowly. After a disastrous mission against a railway junction at Carvin in March 1916," the RFC restricted further bombing missions until the preparation for the Somme offensive. The resumption of bombing in July 1916 failed to correct previous errors, although Trenchard's bombing attacks against German airfields demonstrated a significant step forward in the battle for air control." Overall, however, bombing attacks were not concen-

trated, minimizing target damage while maximizing the enemy threat to the bombers. In many cases, "single aircraft . . . [wandered] well behind the front in search of trains."<sup>13</sup> With fighters unable to adequately protect such dispersed operations, ten out of the twenty-eight bombers assigned to the British 4th Army sector went down in the first three days, imposing "no serious interruption" on German troop movements.<sup>14</sup>

The various reorganizations into mission-specific squadrons in late 1916 provided the first step in creating air forces that could achieve concentration at the theater level. However, these new structures did not solve basic disagreements over air employment. In the Battle of Arras in March 1917, the Allies planned an air offensive "to cause the enemy to withdraw his fighting aircraft from the battle front, and to interfere with his railway communications at a time when he was likely to be bringing up reinforcements."<sup>15</sup> The overall effort was diluted, though, as the RFC wanted a "strategic effect" aimed at obtaining air control by forcing the German aircraft on the offensive, but the "Army commanders, who controlled the great majority of the squadrons capable of bombing, wanted to use them for tactical purposes on their own limited fronts."<sup>16</sup> Herein lies the roots of many of today's parochial debates of control of the air and employment of air weapons. A basic tension existed between the tactical perspective of the army commander on the front line, and the operational perspective of the army and air force commanders fighting the theater battle. Nevertheless, the RFC managed some success. As Canadian ace Lieutenant Colonel Billy



Bishop records: "scores of counterattacks were broken up before the Germans had fairly launched them. Our machines were everywhere back of the enemy lines."

The Battle of Arras was significant from the German perspective as well. For the first time, Germany introduced "specially built ground attack fighters," significantly improving direct air support of troops in contact." Thus, by 1917 the primary missions for aviation were tactical and strategic reconnaissance (to include artillery spotting), air control, strategic bombing, air interdiction, and close air support. Already, specialized equipment and organizations distinguished the various flying units from one another.

These events set the stage for 1918, the final act of World War I. Onto this stage came a new actor: the United States of America. Starting with a blank slate in terms of air equipment, personnel, and doctrine, the AEF Air Service borrowed equipment and ideas from the British and French. From an initial battle-ready status in July 1918, the air service expanded rapidly. By September 1918 Colonel Billy Mitchell commanded a multinational air force of nearly 1500 aircraft at St. Mihiel. The American aviation experience in that offensive in particular, while not itself decisive, illustrates the great distance air employment concepts had come in four years of war. Mitchell finally had the centralized organization and specialized equipment to implement Trenchard's offensive air doctrine.

### SECTION III: 1918 AND THE AMERICAN CONTRIBUTION

Billy Mitchell preceded the American forces to Europe, coordinating with the French air service and the RAF to lay a foundation for the American air service. Mitchell was thus able to reap the benefits of the lessons learned through the blood of the other air services. Despite the reorganizations of other nation's services which facilitated theater-wide employment of air power, the US Army entered the war with its priority for aviation fixed on army cooperation missions." In contrast to his later views, even Mitchell felt aviation did not have an independent role during the war; however, to best support the army, Mitchell did recognize the imperative for control of the air, as well as the need for independent offensive action to secure it:

Based on the theory that no decision can be reached on the ground before a decision has been gained in the air, the French General Staff has requested in addition to the aviation units which form a part of the American troops coming to France, there be organized a number of large aeronautical groups for strategical operations against enemy aircraft and enemy material, at a distance from the actual line. These units would . . . have an independent mission very much as independent cavalry."

Thus, Mitchell clearly saw the primary mission of an air force was to gain and maintain control of the air; without this, no army could seriously expect to win. Mitchell also agreed with Trenchard's basic premise, that control of the air required offensive strikes to make the enemy devote more resources to defense and attrit the enemy aircraft and airfield facilities.

Mitchell's reference to "strategical operations" refers to military targets directly related to the military forces in the

field. Today most of these would be considered operational level targets. Mitchell, during the war, was not advocating strategic bombing operations against the enemy population and political leadership. On the contrary, Mitchell's "General Principles", published by the Information Section of the Air Service in April 1918, show that he felt the best way to fight the war was through integrated air and land operations:

1. The issue of war depends primarily on the destruction of an enemy's military forces in the field. To bring this about all elements of a nation's military power are employed to bring about a decision on the field of battle in the shortest time possible.
2. An army is composed of various arms and services whose complete interdependence is necessary for efficiency. No one arm alone can bring about complete victory.
3. The efficiency of an army is measured by its ability to carry destruction to the enemy's forces.
4. The efficiency of any arm is dependent on its military training, experience, and direction.
5. The Air Service of an army is one of its offensive arms. Alone it cannot bring about a decision. It therefore helps the other arms in their appointed mission. The measure of this help is in its efficiency in its mission."

In June 1918 American airmen tested these principles in combat opposing one of Germany's last major offensives of the war.

General Ludendorff, with his air force concentrated under General von Hoepfner, had begun a series of major offensives in March 1918 to achieve a breakthrough and obtain a decisive victory before America could bring her military potential to bear on the side of the Allies. Following initial successes which nearly broke the British lines in the vicinity of the Somme River, Ludendorff

continued to exhaust his manpower and equipment,<sup>62</sup> believing just one more great push would achieve a breakthrough which would end the war. The fourth such attempt was aimed at Paris, with the objective of drawing reserves away from the British front. Ludendorff believed this would render the British vulnerable to defeat in Flanders, where he could then strike his final blow. However, as German armies crossed the Aisne River on 27 May 1918, their progress exceeded Ludendorff's expectations, so he allowed them to continue to the Marne River and attempt a breakthrough there.

The Allies, recognizing the criticality of the situation, rushed in all available reserves to stop the German drive. Despite his earlier commitment to not allow Americans to be subordinate to the forces of another nation, Pershing consented to the assignment of American forces to assist French forces in blunting the German drive. As Pershing wrote to Generalissimo Foch: "Everything that we have is at your disposal . . . to use as you like--we are here to be killed."<sup>63</sup> The point of the German salient was in the vicinity of Chateau-Thierry along the Marne River. It was here that American aviators discovered what other air services already knew: aircraft dispersed to tactical level ground units were unable to mass and thus could not effectively provide control of the air.<sup>64</sup> The more centralized German aviation organizations provided mass at the critical point; "initially outnumbered by a 3:1 ratio, von Hoepfner's mobile groups achieved a thirty percent superiority in aircraft after they concentrated for the offensive."<sup>65</sup>

Making matters worse for the Americans was the dire situation

of the French Sixth Army, whom they were supporting: "hard pressed on the ground, the Sixth Army demanded that they fly barrage patrols over the entire stretch of lines and in doing so, the neophyte flyers met defeat in detail."<sup>64</sup> Concerning this situation, Billy Mitchell commented:

We were now engaged in daily and constant fighting. Major Gerard desired that we put patrols along the front, to act defensively against the German observation planes that were coming over to reconnoiter. This I considered poor strategy and told him so; but we put it into effect. Of course, the Germans merely waited until they saw our small patrols of five or six airplanes and then jumped on them with vastly superior numbers . . . . The Germans employed formations of from twenty to thirty machines and it was merely suicide for us to continue to act as we did in small patrols.<sup>65</sup>

Despite these rough beginnings, the combined air and ground forces of the Allies were able to force a culmination of the German offensive:

The swelling list of German casualties and the steady influx of American and Allied reinforcements had produced an equilibrium of strength between the opposing forces. The complete success of the Allied counter-attack on the 18th of July near Soissons marked this turning point in the year's campaign, and commenced the second phase of the Allied operations. Thereafter, the initiative lay with the Allies.<sup>66</sup>

With this shift in initiative came another change: Billy Mitchell succeeded Brigadier General Benjamin Foulois as the Chief of Air Service, 1st American Army. In this new position Mitchell had two advantages which he applied to correct the initial bias of the U.S. Air Service towards army cooperation missions. First, he had the authority and drive to create large scale air operations. Second, the offensive nature of contemplated Allied operations allowed him to concentrate on offensive air operations at the expense of defen-

sive patrols over friendly troops and close escort missions for army-cooperation aircraft.

Mitchell recognized the need for centralized control of offensive air operations, as evident in a message he sent to the Chief of Staff, First American Army on 7 September 1918, requesting that "all tactical missions for any branch of the army air services be given to the chief of air service for execution."<sup>66</sup> Mitchell specifically included all American Army units or French units attached to the Army, the French Air Division, and the French Night Bombardment Wing in his request. Mitchell, as a result, essentially became the first joint force air component commander (JFACC),<sup>70</sup> commanding a multinational air force of 1500 aircraft for the Allied offensive at St. Mihiel in September 1918.

Mitchell's scrutiny of previous Allied air operations served him well in planning the employment of aviation for the St. Mihiel offensive. By concentrating all Allied aviation directly supporting the forces in the St. Mihiel offensive, Mitchell achieved both mass and unity of effort. Furthermore, Mitchell phased the air operations in order to maximize its effect during critical points in the battle. Phasing effectively combined operational and tactical level objectives during the offensive. Mitchell's initial plans for St. Mihiel are reproduced in the Appendix.

Billy Mitchell was able to effectively integrate the war in the air with the war on the ground because he thought at the operational level; he envisioned a seamless battlefield which extended from the friendly rear area all the way through the front lines into

the enemy rear. He also saw the battle in terms of time, sequencing air actions to achieve maximum effect at the critical point and time. His use of barrage patrols in the preparation phase, while not the most effective long-term solution for gaining control of the air, achieved his short-term objective of hiding Allied preparations from German reconnaissance aircraft. Similarly, his instructions to pursuit aircraft and bombardment aviation to maintain normal activity during the preparation phase helped the Allies gain surprise as to the actual place and time of their offensive.

Since the preparation phase did not make use of extensive offensive air efforts, Mitchell could not possibly attack every target desired by the ground commanders on the eve of the battle. Instead, he focused on operational level targets which would contribute the most to the next day's battle, such as enemy airfields, railway stations, ammunition dumps, and enemy cantonments. Mitchell later wrote that he "intended to change ordinary procedure and employed massed air attacks against the vital centers in the enemy's rear."<sup>71</sup> The last-minute attack of these key nodes, while not necessarily destroying them, would cause significant short-term paralysis and confusion which Allied air and ground forces could exploit during the following morning's attack. During the actual attack, Mitchell recognized the importance of attacking the enemy in depth, splitting pursuit aviation to protect troops in contact while conducting deep patrols to keep enemy fighters on the defensive and protect Allied bombers during their deep missions. Finally, Mitchell saw the potential of the aircraft to exploit successes on the

ground, disrupting and destroying enemy forces in their retreat.

The execution of Mitchell's plan was no less impressive. Mitchell complemented the defensive efforts of his barrage patrols by dispersing aircraft, camouflaging airfields and key installations, and adding fake buildings and phoney aircraft to support his deception. These efforts to achieve surprise contributed to a local superiority for Allied aircraft of approximately 5:1 over the Germans." Mitchell exploited this local superiority, as well as bad weather which hindered the German defenders, by dividing his forces to attack the depth of the battlefield:

[Mitchell's] pursuit planes kept a continuous patrol up to 16000 feet during the three days of air operations to protect the reconnaissance, photographic, and artillery control planes operating to a depth of eight miles in enemy territory. His strategic reserve, divided into two divisions of 500 planes each, attacked enemy installations, dumps, troop concentrations, and similar targets to a depth of 20 miles."

In General Pershing's words, this was "the largest assembly of aviators that had ever been engaged in one operation on the western front."

The Allied infantry went "over the top" on the morning of 12 September, pushing a less than determined German defense out of the salient. With the inclement weather limiting German air attacks, "all three American fighter groups . . . [concentrated] their attacks on the salient's main chokepoint, the Vigneulles-St. Benoit Road." While the Allied ground attack achieved most of its objectives by the end of the first day, the Allied air forces continued to attack the retreating German forces. By 16 September the American aviators alone had flown over 3,300 sorties, expended 30,000



rounds of machine-gun ammunition against tactical targets such as troops and artillery, conducted 1,000 interdiction missions on targets such as railroad junctions and ammunition depots, and downed sixty-three enemy aircraft."

Mitchell oversaw a similar offensive effort in support of the AEF in the Meuse-Argonne, and along with Trenchard, had plans for major air offensives in 1919. However, to the relief of all involved, these were not to occur, as an armistice ended the Great War on 11 November 1918. Yet in the span of four years, the evolution of air power had ushered in a revolution in warfare. Many air power concepts forged under fire in World War I have become doctrinal tenets, although some of these lessons required another world war for final acceptance."

#### SECTION IV: AIR POWER LESSONS AND CLASSICAL THEORIES

Following World War I, nations were sick of war, revulsed particularly by the bloodshed caused by attrition warfare on the western front. The gospel of strategic bombing, preached by Douhet, Mitchell and Trenchard," to name just a few, fell upon a receptive public. Because of the exaggerations made on behalf of strategic bombing, and its ability to save lives by attacking enemy population centers and industries directly, much of the public saw air power as a replacement for the other services.<sup>40</sup> Yet the actual experience of bombing in World War I did not adequately support many of the projections made for air power in future warfare.

If the prophets of air power were guilty of some exaggeration," traditionalists in the two senior services were equally guilty of failing to adapt to the changes in warfare brought by air power. Perhaps their intransigence was in part a defensive reaction to protect their turf against the public's zealous belief in air power. Following the war, the U.S. Army made an honest attempt to evaluate the lessons of air power during World War I by appointing a board to study the impact of aviation. When the results recommended an independent air organization, Army leadership quickly squelched the report. Instead, they ordered the head of the air service, a non-flyer, to conduct another study; predictably, this one was more in line with traditional army thought.<sup>41</sup>

Thus, air power enthusiasts focused increasingly on the strategic employment potential of air power, feeling this made the strongest case for breaking away from parochial army traditions.<sup>42</sup>

In contrast, Army leaders continued to focus on the tactical use of air power, subordinated to divisions and corps, as the primary use for aviation. This created a vacuum of thought at the operational level of war; few military thinkers focused on the lessons of integrated air and ground combat operations from a theater perspective. Yet the Great War provided many such enduring lessons, lessons which make the case for an independent air force organization, coequal with the other services, while reinforcing classical military theories which place a premium on combined arms operations. Based on the information presented in this monograph, the following are the operational level lessons of air power from World War I.

The first job of air forces is not support of tactical ground units, but gaining and maintaining control of the air.<sup>40</sup> The experiences of World War I show that this mission alone mandates control by an independent organization commanded by flyers. Recommendations from a U.S. Army Board of Officers in July 1917 leaves no doubt as to the importance they placed on controlling the air:

The Board believes that it is a cardinal principle in warfare that a decision in the air must be sought and obtained before a decision on the ground is reached. Absolute and unchallenged superiority in the air can perhaps never be attained although possibly it may be attained for short periods of time; but experience of three years' war has amply shown the side which can at critical times dominate the enemy in the air has taken the first, if not the vital, step toward victory.<sup>41</sup>

Yet opinions of leaders within the air service differed with those of senior Army leaders in how to maintain control of the air. General Pershing, as Commander of the AEF, wanted defensive patrols to provide local air superiority over his troops, while Mitchell

"believed the best way to attain it was to hit the enemy's air strength behind the lines, removing the source of the threat by attacking the enemy's airfields and shooting his planes out of the air before they could reach the front."<sup>44</sup> This introduces another lesson.

Control of the air requires a situationally dependent blend of offensive and defensive missions; defensive missions alone will not guarantee control of the air. Experiences from the war, especially the air battles at Verdun and St. Mihiel, show that while defensive patrols may be effective and even appropriate for certain tactical situations over short periods of time, long term air control requires offensive air missions. This concept is consistent with classic military thought. Carl von Clausewitz's concept of defense as a "shield made up of well-directed blows" depicts an interaction between offensive and defensive actions. While Clausewitz holds that "the defensive form of war is intrinsically stronger than the offensive,"<sup>45</sup> he bases much of his reasoning on advantages terrain provides the defender. In air warfare, while still present, these advantages are minimized.<sup>46</sup> Mitchell's phasing at St. Mihiel was consistent with this principle, as he employed barrage patrols prior to the offensive, since security was the most important short-term objective. However, once the offensive began, he shifted to attacks on airfields and other deep targets as the best method for gaining control of the air. This also is consistent with Clausewitz's view of defense having a negative purpose and offense a positive one:

The effort to destroy the enemy's forces has a positive purpose and leads to positive results, whose final aim

is the enemy's collapse. Preserving our own forces has a negative purpose; it frustrates the enemy's intentions--that is, it amounts to pure resistance, whose ultimate aim can only be to prolong the war until the enemy is exhausted."

Clausewitz's view of the interaction of the offense and defense is especially applicable to the battle for control of the air in World War I. Mitchell displayed a firm grasp of this idea in his mixture of offensive and defensive pursuit missions at St. Mihiel. In contrast, Trenchard's offensive policies, while always intended to support the British Army, caused high attrition among British pursuit squadrons without achieving the goal of air superiority. Trenchard's offensive policies were not dependent on the tactical or even operational level military situation, but instead used the RFC in "a constant offensive role to establish a moral ascendancy over the enemy."<sup>66</sup> While most classical theorists acknowledge the importance of the moral factor in war, they link it to the material." By ignoring material factors such as the experience level of his pilots and the relative capabilities of his aircraft *vis a vis* the enemy, Trenchard misapplied the principle of offensive action:

What [Trenchard] had failed to realise was that command of the air was gained by technological superiority--more and better machines, armament innovations and superior training of aircrew. When the RFC possessed these they dominated the aerial battlefield, and when German developments gave their nation the advantage, the RFC lost their command of the air."

Trenchard's error leads to a statement of the third air power lesson from the war.

The industrial revolution has increased the effect of technol-

ogy upon warfare; in some instances, technology itself has become decisive at the operational level. Sun Tzu observed that "a victorious army wins its victories before seeking battle; an army destined to defeat fights in the hope of winning."<sup>22</sup> With the fast-paced advance of technology<sup>23</sup> and its increasing impact in battle, preparation for battle, in terms of equipment and training, could predetermine the outcome of actual battle. This was especially true in the struggle to control the air. Thus, if technology influenced tactical success, and tactical successes ultimately determined operational success, aircraft and weapons technology became a critical sub-element in gaining control of the air.<sup>24</sup> Yet superior weapons did not offset poor operational concepts, such as the decentralized control of air power.

Control of the air requires theater level command and control to achieve mass for offensive action or rapid concentration in the defense. This is a vital lesson with strong Clausewitzian roots: "there is no higher and simpler law of strategy than that of keeping one's forces concentrated."<sup>25</sup> A corps or division commander was unable to envision a theater air battle; concentration to him was limited to those assets in his sector. With limited resources, economy of force necessitated the denial of lower priority missions to achieve mass at the critical time and place. This concept supports Clausewitz's "first rule in strategy":

Relative superiority, that is, the skillful concentration of superior strength at the decisive point, is much more frequently based on the correct appraisal of this decisive point, on suitable planning from the start; which leads to appropriate disposition of the forces, and on the resolution needed to sacrifice non-essentials

for the sake of essentials--that is, the courage to retain the major part of one's forces united."

Thus, the mission of gaining control of the air was a theater level mission, requiring both an operational vision and aviation expertise. This same logic applies to the selection of targets for aerial bombardment; the examples from World War I showed success in bombing required concentration.

Aircraft compress the battlefield in time and expand it in space. When appropriately synchronized in the theater commander's overall effort, concentrated bombing provides an effective tool for exploiting enemy operational level vulnerabilities. Aircraft offer a potentially greater payoff when employed against the enemy rear (operational or strategic.) Damage done there will be more permanent and have a greater impact on the enemy (both in material and moral terms.) However, effects from these attacks may take longer to impact the situation at the front line. Therefore, an operational air employment plan must be flexible enough to provide a response to changes in the tactical ground situation which threaten operational success.

With limited resources, an air service could effectively bomb only a certain number of targets each day. Tactical target requests were always critical in the eyes of corps and division commanders, but were not necessarily as important in the long term for success in the war. Part of the confusion and disagreement in this area comes from a misunderstanding of classical theories such as Clausewitz's statement that "the destruction of the enemy's force underlies all military actions."<sup>1</sup> Thus, leaders such as Pershing

believed the use of aviation behind the lines was a waste of resources, since its primary job was supporting troops in contact. After all, that is the point at which physical destruction took place. Yet, Clausewitz's explanation reveals a broader interpretation of what he meant by the enemy's force:

When we speak of destroying the enemy's forces we must emphasize that nothing obliges us to limit this idea to physical forces: the moral element must also be considered. The two interact throughout; they are inseparable."

Furthermore, Clausewitz specifically addresses the value of attacking enemy convoys. He only discounts these types of attacks because of the technical difficulties involved; air power removed those technical difficulties.

The writings of Antoine Henri Jomini further support the air service's attacks in depth, as seen in his first maxim underlying all operations in war:

To throw by strategic movements the mass of an army, successively, upon the decisive points of a theater of war, and also upon the communications of the enemy as much as possible without compromising one's own.<sup>10</sup>

Jomini's analysis of warfare was extremely terrain oriented, as he focused on geographically or strategically important decisive points and lines of operations. Jomini favored attacks against the enemy flank and rear to separate them from their base of operations. Aerial attacks by Mitchell's aviators against key railroad junctions behind the German lines simply extended Jomini's thinking from two to three dimensions.

Finally, the Clausewitzian concept of a center of gravity gives credence to attacking certain targets deep behind enemy lines.



Aircraft can sometimes directly attack enemy centers of gravity; as a minimum, aircraft can indirectly impact a center of gravity by attacking decisive points.<sup>101</sup> Clausewitz finds that from the characteristics of both belligerents, "a certain center of gravity develops, the hub of all power and movement, on which everything depends." The concept of a center of gravity allows an army to focus its strength against an enemy and thus "act with the utmost concentration."<sup>102</sup> Yet Clausewitz allows a division of forces when "an attack on separate lines may promise greater results," implying a "concentric attack" against a single center of gravity. Thus, a flank or rear aerial attack, or indirect aerial attack against lines of supplies and reinforcements, coupled with a ground frontal assault would be an acceptable division of effort if indeed focused on the enemy center of gravity.

Sun Tzu's war fighting philosophies also support this idea:

Generally, in battle, use the normal force to engage; use the extraordinary to win . . . In battle there are only the normal and extraordinary forces, but their combinations are limitless; none can comprehend them all.<sup>103</sup>

Sun Tzu's basic premise is that right combination of normal and extraordinary forces will achieve the speed and surprise required to obtain a decisive victory, exploiting enemy material and moral vulnerabilities. Air power's unique ability to use speed for surprise and firepower for shock make it an ideal extraordinary force, especially because of the psychological effects that accompany attack from the air. Hence, the last air power lesson.

The psychological impact of an air attack often outweighs

actual physical damage. Clausewitz shows the importance of psychological effects in war by emphasizing the importance of cohesion on a center of gravity:

Forces will possess certain centers of gravity, which, by their movement and direction, govern the rest; and those centers of gravity will be found wherever the forces are most concentrated. But in war . . . the effect produced on a center of gravity is determined and limited by the cohesion of the parts.

Thus, Clausewitz applies center of gravity to both material and moral factors, calling it a "major act of strategic judgment to distinguish these centers of gravity in the enemy's forces and to identify their spheres of effectiveness."<sup>104</sup> This statement also reinforces the need to plan and control air power at or above the operational level of war.

Clausewitz, Jomini, and Sun Tzu all lived prior to air power, yet their theories appear expansible enough to accommodate it. The emphasis in these classical theories on concentration and unity of effort underscores the need to view air power from a theater perspective. Such an operational perspective prioritizes the most critical missions for air, then provides air power in enough mass to accomplish those missions. This principle applies to both control of the air and bombing. Operational level command of air forces, such as Mitchell had at St. Mihiel, provided a clear demonstration of these principles. By having the air forces concentrated under him and understanding General Pershing's overall plan, Mitchell was able to synchronize air and ground forces to attack the enemy in depth and thus concentrate against sources of enemy strength.

## SECTION V: CONCLUSION

A potential danger in seeking lessons from the pages of history is reductionism. Friction introduces a complexity into war, as noted by Clausewitz: "everything in war is very simple, but the simplest thing is difficult."<sup>106</sup> Clausewitz therefore is critical of theories that focus on physical quantities, since "all military action is intertwined with psychological forces and effects." He similarly objects to theories based solely on unilateral action because "war consists of a continuous interaction of opposites."<sup>108</sup>

These criticisms serve as a warning to avoid oversimplification when establishing employment principles for the use of military forces in combat. They are especially appropriate for air power. Technology is the life blood of air power, at times constraining but usually advancing concepts for aerial combat. Therefore an inherent danger exists of devising employment principles based solely on destructive capabilities alone; Holley's analysis reveals this to be a problem during World War I, noting that "formulation of aerial doctrine fell by default to a technical board officially charged with making nothing but technical decisions."<sup>107</sup>

Holley offers the following as an explanation of the relationship between technology and doctrine:

Superiority in weapons stems not only from a selection of the best ideas from advancing technology but also from a system which relates the ideas with a doctrine or concept of their tactical or strategic application.

For the joint or air planner, this means more than just selecting key enemy targets for destruction and allocating the necessary sorties to do the job.<sup>108</sup> Planners must also as a minimum consider

enemy counter-moves, the theater commander's priorities, the political end state desired, and the potential long term effects of target destruction. Otherwise, aerial bombardment becomes an attrition process that may or may not contribute to gaining victory and establishing peace in the shortest time possible with the lowest cost of life.

This monograph has attempted to avoid that kind of oversimplification in examining air power lessons from the First World War. In that war, disagreements between air service leaders and the ground commanders they supported initially focused on the offensive use of aircraft to gain and maintain control of the air. Division and corps commanders favored defensive tactics which dispersed aircraft across the front and confined them to defensive patrols over friendly troops. Such limitations made it impossible to achieve mass and ceded the initiative to the enemy. These defensive tactics severely limited the ability of observation and artillery spotting aircraft to accomplish their missions, missions at the time considered the most important contribution of aviation. Thus, the lesson learned by war's end was that control of the air was actually the first priority for the air services, requiring theater level command and control to achieve concentration through a mixture of offensive and defensive missions.

The other major disagreement between air service leaders and their ground counterparts concerned the use of aircraft for bombing missions deep in the enemy rear. Technological limitations in bombing accuracy and explosive carrying ability obscured the real

potential for bombers; here indeed was a case where doctrinal concepts began to outpace technology. Nevertheless, analysis of the development of interdiction bombing reveals a solid doctrinal foundation for using air power to attack military targets throughout the enemy rear area. Just as was the case with control of the air, effective interdiction required concentration; this, in turn, required theater command and control to ensure scarce aviation assets attacked the targets deemed to have the greatest impact on the theater battle. Yet ground commanders at corps level and below could scarcely share this perspective, not caring that an operational level strike might prevent enemy reserves from reaching the front next week, if their units might not be around to fight then anyway.

And so today, roughly seventy-five years after the armistice ending the Great War, parochial views still differ over the use of air power at the operational level of war. With the addition of air defense missiles to tactical units for point defense, the U.S. Army has been content to let the U.S. Air Force seek air superiority the way it sees fit. However, the question of theater air defense and ballistic missile defense has sparked a renewal of an old controversy. As for interdiction, technology has provided corps and divisions the capability to influence the enemy at greater ranges, creating the potential for a more decentralized approach to interdiction targeting. Yet one wonders if this is but another example of a technological capability scripting a doctrine, rather than an objective approach which considers the battlefield as a whole.

The temptation to focus on one's own service in these matters

is natural, especially when budget dollars are at stake. World War I revealed mistakes at both extremes: traditionalists who failed to adapt to new technologies and clung to old doctrines even after they were outmoded, and visionaries who exaggerated the capabilities of new technologies, hindering the effective application of these weapons to the battle at hand. The cost became evident in World War II, when several of the air power lessons presented in this monograph had to be relearned. Therefore, the challenge for the future is to maintain a flexibility of mind which can adapt to new technologies and concepts of combat employment, while at the same time rigorously examining these concepts in light of time-honored military theories. Such a contextual understanding of new technologies should shift debate away from parochial power duels and keep the focus on how all the services contribute to victory in a variety of scenarios. The next war may not provide the time necessary to relearn lessons from the past.

## APPENDIX: MITCHELL'S PLAN FOR ST MIHIEL

Colonel Billy Mitchell provided the following summary of his proposed operations for St. Mihiel to General Pershing:<sup>108</sup>

Headquarters, Air Service  
First Army  
August 20, 1918

Memorandum for  
Commanding General,  
1st Army.

The employment of aviation in the proposed attack is divided into four phases:

- I. Preparation.
- II. Night preceding the attack.
- III. Day of the attack.
- IV. Exploitation.

### I. Preparation:

- a) In order that the attack be made by surprise it is important that the aspect of the sector be not changed.
- b) The general mission of aviation (in I.) is to--
  - 1) Absolutely prevent access to our lines by enemy reconnaissance aviation;
  - 2) Secure complete information about hostile formation by means of photo missions and night reconnaissance without arousing the suspicions of the enemy.
- c) Mission of pursuit aviation in I--
  - 1) Constant patrol on our lines in order to procure an absolute barrage;
  - 2) Usual offensive patrols in order to maintain the normal activity of the sector.
- d) Mission of bombardment aviation: Normal work of the sector.
- e) Mission of observation aviation--
  - 1) Maximum photographic reconnaissances;
  - 2) Night reconnaissance when the enemy movements are suspected.

## II. Night Preceding the Attack:

- a) Mission of bombardment aviation; during the whole night preceding the attack:
  - 1) Attack by high explosive bombs (English Aviation) of the strategical objectives, i.e., airdromes, stations, railroad crossings, bridges, ammunition dumps, (confirmed by photos).
  - 2) General attack by bombs on personnel (French Aviation) of camps, enemy cantonments and airdromes.

## III. Day of the Attack:

- a) Mission of pursuit aviation--
  - 1) Offensive mission--High patrols deep to the rear of the enemy lines to break up enemy aerial formations and help the bombardment aviation in its mission of bombarding enemy airdromes, and scattering enemy columns on the road.
  - 2) Protective mission--If the infantry signalling is efficient, and in this case only, an attack may be made by machine guns on the enemy's reserves which are in formation for counter-attack. To prevent enemy infantry planes from entering the battle zone. To help the advance of the tanks.
- b) Mission of bombardment aviation--Protected by pursuit aviation to attack and destroy enemy airdromes, break up trains and convoys on the roads, and carry on the same work as that of night bombardment aviation in destroying stations, bridges, railroad crossings, ammunition dumps, cantonments, etc.

## IV. Exploitation:

The squadrons move forward to the new advanced fields which were previously prepared, extend their zone of action and execute the same missions as the day before. However, as a retreating army is in open ground, the airplanes will operate as low as possible in order to seek the obligatory points of passage of the enemy's columns and to destroy them with bombs and machine guns at such places.

The high explosive bombardment aviation (English Aviation) will be specially detailed to destroy railway crossings and important bridges located in the zone far from the battlefield.

WM. MITCHELL  
Colonel, A.S.S.C.  
C.A.S., 1st Army



## Notes

1. Joseph J. Corn, The Winged Gospel (New York: Oxford University Press, 1983), 11. Corn compares the growth of aviation in America with the growth of Christianity. Corn draws a parallel between the prophets and saints of old and the 20th century air power prophets who evangelized the nation in the name of air power, noting that even the carnage of aerial conquest did not diminish popular support for aviation.
2. Michael S. Sherry, Rise of American Air Power (New Haven, CT and London: Yale University Press, 1987), 20.
3. Herbert Molloy Mason Jr., High Flew the Falcons (New York: J. B. Lippincott Company, 1965), 17.
4. I. B. Holley Jr., Ideas and Weapons (Hamden, CT: Archon Books, 1971), 12.
5. Ibid., 160.
6. James L. Stokesbury, A Short History of Air Power (New York: William Morrow and Company, Inc., 1986), 112.
7. Edward Homze, "The Continental Experience," in Air Power and Air Warfare, ed. Alfred F. Hurley and Robert C. Ehrhart (Washington, DC: Office of Air Force History and United States Air Force Academy, 1979), 37.
8. Historian John W. R. Taylor, quoted in Homze, 41.
9. Robin Higham, Air Power: A Concise History (New York: St. Martin's Press, 1972), 1.
10. Clausewitz, On War, trans. and ed. Michael Howard and Peter Paret (Princeton, N.J.: Princeton University Press, 1976), 77-78. Clausewitz speaks of three extremes based on the interactions of two or more forces. First, "war is an act of force, and there is no logical limit to the application of that force. Each side, therefore, compels its opponent to follow suit; a reciprocal action is started which must lead, in theory to extremes." The second is that since the aim of both sides is to disarm or subdue the other, war is "the collision of two living forces," so that "he dictates to me as much as I dictate to him." The third extreme is that "if you want to overcome your enemy you must match your effort against his power of resistance, which can be expressed as the product of two inseparable factors, viz. the total means at his disposal and the strength of his will." Thus, although Clausewitz acknowledges that reality modifies these extremes in practice, a situation in which national survival was at stake would naturally lead to higher levels of violence.

11. Jean de Bloch, The Future of War (Boston: World Peace Foundation, 1914), xvi-xvii.

12. One could argue that de Bloch's prediction of the impossibility of war was indeed fulfilled by nuclear weapons. Nuclear war fighting doctrine centers on deterrence, an idea founded on the prevention of wars, not the winning of them.

13. Robert Saundby, Air Bombardment (New York: Harper & Brothers, 1961), 30. Saundby writes "it did not make any sense to maintain that the man who drove an ammunition lorry behind the front was a combatant, while the man who made the ammunition or transported it to a theater of war was a noncombatant."

14. Weakening the enemy's will to resist by direct attacks on civilian targets was rationalized on the basis that it would shorten the war and end the terrible carnage in the trenches. Technology had provided a weapon which could strike area targets in the enemy rear, but not with enough accuracy to pinpoint targets and avoid significant collateral damage. The urge to retaliate for such damage increased support for further bombing to weaken enemy morale, since that was the only credible objective based on early bombing technology. Sherry, 15, describes the hatred inspired by this vicious cycle: "So-called reprisal raids went so far beyond the misdeed that provoked them that no calculated desire to even the score or deter further wrongs could have alone inspired them. The target of attack was not so much the enemy as the flagging spirits of one's compatriots. Air war, like no other weapon in the modern arsenal, satisfied yearnings for blood and punishment among peoples deeply wounded by war and deprived of decisive victories."

15. Edgar S. Gorrell, "Early History of the Strategical Section," reprinted in Maurer Maurer, The US Air Service in World War I, Vol II of IV (Washington, DC: Office of Air Force History, 1978), 143.

16. For simplicity, this monograph uses theater level of war and operational level of war interchangeably. Support for this view comes from the definition for operational level of war in Joint Pub 5-00.1 Doctrine for Joint Campaign Planning [Initial Draft] (Washington, DC: Office of the Chairman of the Joint Chiefs of Staff, June 1992), I-11. "Operational level of war. This is the level of war where major operations are planned, conducted, and sustained to accomplish strategic objectives within theaters or areas of operation. Activities at this level link tactics and strategy by establishing operational objectives needed to accomplish the strategic objectives, sequencing events to achieve the operational objectives, initiating actions, and applying resources to bring about and sustain these events. These activities imply a broader dimension of time and space than do tactics; they ensure the logistic and administrative support of tactical force, and provide the means by which tactical successes are exploited to achieve strategic objectives."

17. Holley, 15.
18. Higham, 2.
19. Ibid.
20. Michael Paris, Winged Warfare (New York: St. Martin's Press, 1992), 156. While this concept "horrified many cavalymen" as aviation appeared to make "the traditional use of cavalry obsolete," others argued aviation had only a limited role in early warning, leaving "traditional cavalry to drive [the enemy] from the field."
21. Mason, High Flew the Falcons, 17.
22. Horze, 38.
23. Mason, 22.
24. Paris, in Winged Warfare references the British Field Service Regulations of Spring, 1914, which assigned airplanes a "primary reconnaissance role" and a secondary function of "preventing hostile reconnaissance." Although this concept predated hostilities, actual air-to-air combat did not occur immediately at the beginning of the war, primarily due to shortcomings in equipment and tactics.
25. Paris, 157. A 1916 Royal Flying Corps statement revealed the protection requirements for reconnaissance missions: "Under existing conditions it is essential to provide protection in the form of patrols for machines employed on artillery work. Information can no longer be obtained by dispatching single machines on reconnaissance duties. The information now has to be fought for, and it is necessary for reconnaissance flights to consist of at least five machines in formation."
26. Mason, High Flew the Falcons, 17. John E. Johnson, Full Circle (New York: Ballantine Books, 1964), 25, commented that initially "the Germans were on the defensive, and few Fokkers, or other enemy machines, crossed the front. This was an odd state of affairs and showed that the leaders of the German Air Service did not understand the air weapon..."
27. Johnson, Full Circle, 34.
28. Mason, The Lafayette Escadrille, 66.
29. Ibid.
30. Andrew Boyle, Trenchard (New York: W. W. Norton & Company, Inc., 1962), 168-169.
31. Ibid., 170.

32. Ibid.
33. Ibid.
34. Ibid., 171.
35. Ibid., 168.
36. Ibid., 186.
37. Ibid., 188.
38. See short summary of criticism on page 32, this text.
39. Higham, 36.
40. Ibid., 37.
41. Johnson, Full Circle, 27.
42. R. A. Mason, "The British Dimension," Air Power and Air Warfare (Washington, DC: Office of Air Force History and United States Air Force Academy, 32. Mason reproduces Trenchard's statement: "Though material damage is as yet slight when compared with moral effect, it is certain that the destruction of 'moral' [morale] will start before the destruction of factories and, consequently, loss of production will precede materiel damage."
43. Eugene M. Emma, The Impact of Airpower (Princeton, N.J.: D. Van Nostrand Company, Inc., 1959), 38.
44. Mason, "The British Dimension," 31, records the "first analysis of strategic targets based on scientific principles" occurred in a paper presented to the British Air Board. The paper "identified chemical plants as the key industrial targets because of the dependence of the German war industry on them and their vulnerability to air attack." The paper examined individual factories to "identify the departments whose destruction would have the greatest effect," calculating the "bombloads required to achieve the necessary amount of destruction." Conclusions stated that success would require "concentrated and repeated attacks." Saundby, Air Bombardment, 26, finds three primary target groups in his study of World War I strategic bombing: production, transportation, and morale.
45. For definition of operational level of war, see endnote number 16.
46. Holley, 161.
47. See Boyle, 138. One of the earliest such raids occurred at Ypres in April 1915, when four aircraft took off to bomb a railway station which served as a funneling point for reserve forces. Only

one aircraft reached the target, releasing a mere 100 pound bomb.

48. Ibid., 150. One of many examples was the Battle of Loos in September 1915, where even a relatively coordinated British and French raid scattered five and a half tons of bombs over 35 different targets; German records indicate that only two of these air strikes were successful. These attacks failed to accomplish their primary objective of "preventing the movement of reserves . . . to the Loos front."

49. Saundby, 12.

50. Ibid., 14.

51. Ibid.

52. Ibid., 16. Trenchard's concept for gaining control of the air at the Somme also included bombing German airfields. These missions also failed due to lack of concentration: "In view of the unsatisfactory situation in the air at this time, [bombers] were mainly employed in attacks against enemy airfields. This is the first example of any serious attempt to use bombers to influence the air situation. Unfortunately, instead of concentrating against a few of the more important airfields, almost every known landing-ground seems to have been sprinkled, with the result that the German air force suffered little material or moral damage."

53. Ibid., 15.

54. Ibid.

55. Ibid., 17.

56. Ibid.

57. William Bishop, Winged Warfare, ed. Stanley Ulanoff (Garden City, N.Y.: Doubleday and Company, Inc., 1967), 88.

58. Hozze, 39.

59. Holley, 159: "The U.S. entered the war without a clearly defined doctrine of aerial warfare. Insofar as a doctrine had been formulated, it favored a role of army-cooperation or close support rather than an offensive or strategic role." Holley points out that this initial bias influenced the types of aircraft produced, as well as the experience base developed within the air service. Holley comments that this caused a "self-perpetuating . . . cycle" that was difficult to break away from, even after the war.

60. Ibid., 47.

61. Maurer Maurer, The US Air Service in World War I, Vol II (Washington, DC: Office of Air Force History, 1978), 175.
62. William Mitchell, Memoirs of World War I (New York: Random House, 1960), 207-208. Mitchell records the reports that the "Germans had shut down all their ammunition factories because they had enough ammunition to last them until the end of the war, no matter if it took two or three years. They had taken all the available men from the factories and from the interior of Germany and put them into the ranks for this great attack. German troops had been brought up from Italy, and reserves and second-line troops from the Russian frontier."
63. John J. Pershing, quoted in Ronald W. Yoshino, "A Doctrine Destroyed: The American Fighter Offensive, 1917-1939," (Ph.D. dissertation, Claremont Graduate School, 1985), 154.
64. Thus, "Americans had to relearn that without a fighter offensive sweeping far into German territory, all missions were basically defensive because they left the initiative in enemy hands." Yoshino, 171. Other shortcomings included the *ad hoc* squadron structure which undermined unit cohesion and effectiveness, and the lack of doctrine for large scale aerial maneuvering.
65. Ibid., 156.
66. Ibid., 155.
67. Mitchell, 209.
68. H. A. Toulmin Jr., Air Service American Expeditionary Force 1918 (New York: D. Van Nostrand Company, 1927), 36.
69. Maurer, Vol III, 103.
70. According to the definition in Joint Pub 5-00.1, GL-9, the "joint force air component commander derives his authority from the joint force commander who has the authority to exercise operational control, assign missions, direct coordination among his subordinate commanders, and redirect and organize his forces to ensure unity of effort in the accomplishment of his overall mission. . . . The joint force air component commander's responsibilities will be assigned by the joint force commander (normally these would include, but not be limited to, planning, coordination, allocation, and tasking based on the joint force commander's apportionment decision)."
71. Yoshino, 192.
72. Ibid., 204.
73. Harold B. Hinton, Air Victory: The Men and the Machines (New York: Harper & Brothers Publishers, 1948), 31.

74. Arthur Sweetser, The American Air Service: A Record of its Problems, its Difficulties, its Failures, and its Final Achievements (New York and London: D. Appleton and Company, 1919), 327.

75. Yoshino, 209.

76. Herbert Molloy Mason Jr., The United States Air Force A Turbulent History (New York: Mason/Charter, 1976), 64.

77. Sweetser, 327.

78. As a result of the subordination of American aviation to tactical ground units at Kasserine Pass in World War II, the American aviators were unable to attain air superiority even over friendly troops. This event prompted a revision to air doctrine. The result was War Department Field Manual FM 100-20, "Command and Employment of Air Power," (Washington, DC: War Department, 21 July 1943). Of note were the following statements: "Land power and air power are co-equal and interdependent forces; neither is an auxiliary of the other." (page 1) "The inherent flexibility of air power is its greatest asset. This flexibility makes it possible to employ the whole weight of the available air power against selected areas in turn; such concentrated use of the air striking force is a battle winning factor of the first importance. Control of available air power must be centralized and command must be exercised through the air force commander is this inherent flexibility and ability to deliver a decisive blow are to be fully exploited.

79. Douhet's views received the most notoriety in The Command of the Air, trans. Dino Ferrari (New York: Coward-McCann, 1942; reprint ed., Washington, DC: Office of Air Force History, 1983). The Italian experience with Caproni bombers provided Douhet with an outspoken strategic vision during the war, even landing him in prison in 1916. Mitchell and Trenchard, in contrast, leaned toward tactical support of army operations as the main role for aviation during the war. After the war, however, both men became advocates of strategic bombing, partly for political reasons and partly because they truly believed in their cause.

80. Higham, 2. "The history of air power has . . . been confused by the bragging of its prophets and the derision of its enemies. Too often vision has outrun reality and resulted in disappointment and reaction. As newcomers, forced to plead from a position of weakness, airmen carried arguments to their logical extremes and talked about what air power was going to be able to do; and their listeners tended to forget that these were prognostications, accepting them instead as imminent realities." The disagreement over the role of air power became more polarized with time as demobilization transformed theoretical discussions into budget decisions. This pushed both sides to extremes, despite considerable room for compromise. John F. Shiner, Foulois and the U.S. Army Air Corps 1931-1935 (Washington, DC: Office of Air Force History, 1983), 12, sums up

the dilemma for air service officers: "The dispute over Air Service independence that ensued between the flyers and the War Department in 1919-20 did not so much involve a doctrinal conflict over the decisiveness of air power as it did the issues of adequate funding, development, and leadership for military aviation. Air Service officers did not claim that air power alone could win wars or replace the 'queen of battles,' the Infantry. But many of them insisted aviation represented an important offensive striking arm which must be properly developed."

81. Emme, 157, takes the long term view on such exaggeration: "It can be said that the early prophets overestimated the firepower attrition of aerial bombardment in their own time, a quantitative error corrected manifoldly by the advent of atomic weapons. But the intellectual momentum established by the vigor which Douhet, Trenchard, Mitchell, and others attacked the problem of military strategy and organization, brought forth a new school of thought in the art and science of warfare. They provided the spark for a school of thought which attached utmost importance to the air arm as a weapon in warfare. Thus, these men were more than theorists of air warfare. They were the architects of present-day military strategy and the progenitors of tomorrow's exploitation of air space in war."

82. Shiner, 12. "In 1919 . . . Secretary of War Newton D. Baker ordered Assistant Secretary Benedict Crowell to head a new board to make a more thorough investigation of military aviation. Reporting in July, the Crowell Board recommended concentrating all of the government's air activities in a single national air service, coequal with the War, Navy, and Commerce Departments. Both Secretary Baker and the General Staff were upset with this conclusion. The War Department did not want to lose control of its useful auxiliary force. Baker, while wanting the air arm to grow, was totally opposed to the idea of separation. He therefore buried the Crowell report and authorized the Chief of Air Service, Maj. Gen. Charles T. Menoher, to organize a new investigative group. Menoher, a nonflyer, produced a study more to the War Department's liking. Completed in October, the report opposed the creation of an independent department of the air and maintained that a separate air force would violate the principle of unity of command and that air action could not in itself be decisive against ground forces."

83. Stokesbury, 125. "Until air forces could find a viable reason for their existence, they were going to remain stepchildren of the older services. Tactical air power left them still in a supporting role, and true independence would come only when air power was seen as capable of dominating naval and military forces, not simply of supporting them on a tactical level . . . The answer was, of course, strategic bombing."



84. Emma, 49, notes "two great lessons . . . taught by the World War," the first being "an army without an air force contending against one so equipped is practically helpless."

85. Maurer, Vol II, 123.

86. Ibid., viii.

87. Clausewitz, 357-358.

88. In World War I the Germans effectively used air defense artillery to guide them to intercepts against hostile aircraft. Furthermore, aircraft fighting over their own lines typically had less distance to go to their airfields, giving them a longer time on station (an advantage exploited by British fighters in the Battle of Britain in the opening days of World War II.) Finally, pilots flying over their own lines had a potential psychological edge, being familiar with the area and knowing that if they were forced down, they would probably be back in their squadron in a matter of days. Note that none of these depend on specific terrain features, but only on which side of the front lines the battle takes place.

89. Clausewitz, 98.

90. Paris, 237.

91. Clausewitz, on 136, for example, criticizes physical theories of war because "they direct the inquiry exclusively toward physical quantities, whereas all military action is intertwined with psychological forces and effects. They consider only unilateral action, whereas war consists of a continuous interaction of opposites." Sun Tzu's words on 85 further explain Trenchard's error: "Invincibility depends on one's self; the enemy's vulnerability on him. It follows that those skilled in war can make themselves invincible but cannot cause an enemy to be certainly vulnerable. Invincibility lies in the defense; the possibility of victory in the attack. One defends when his strength is inadequate; he attacks when it is abundant."

92. Paris, 237.

93. Sun Tzu, The Art of War, trans. Samuel B. Griffith (London: Oxford University Press, 1963), 87.

94. Edgar Gorrell, The Measure of America's World War Aeronautical Effort (Northfield: Norwich University, 1940), 6, shows the tremendous competition in aircraft and weapons design during the war: "The airplane is one of the most short-lived of all the implements of war! The Spad, upon which we were mainly to rely for pursuit, changed models more frequently than once every thirty days . . . In short, by the time samples could be chosen in Europe and sent back to the United States, manufactured and shipped back, they would be out of date."

95. Holley, 13. Apparently, the impact of this lesson diminished immediately following the war: "it was not until World War II and the approach of total war that military men and governments generally accepted and implemented the thesis of superior weapons as a cardinal tenet of military policy."

96. Clausewitz, 204.

97. Ibid., 196.

98. Clausewitz, 97. Saundby has a strict interpretation of this statement, saying "in more modern terms, it was taken to mean that the aim in war must always be the destruction of the armed forces of the enemy." Saundby goes on to say "it must not be supposed that the Allied was leaders realized the significance of these deviations from the classical doctrine," referring to the "introduction of forces capable of operating in three dimensions." Saundby himself misses the maneuvering room Clausewitz allows himself in defining center of gravity so broadly.

99. Ibid.

100. Antoine Henri Jomini, Art of War ed. J. D. Hittle, reprinted in Roots of Strategy Book 2 (Harrisburg, PA: Stackpole Books, 1987), 461.

101. Decisive points in this context is more than just a point on the ground; it could be a whole line of communication. While an army could hold a decisive point, air power would have to deny it's use to the enemy by aerial mines, blocking chokepoints, destroying bridges or destroying and disrupting communications networks. In the context of the Great War, railroad switching yards and junctions could be decisive points if they were important to a key enemy force.

102. Clausewitz, 617. Clausewitz's intention seems to be to provide a planning tool for facilitating concentration of forces, but even he admits that this is "not . . . a new technique," but "merely . . . a rationale for the actions of every general in history." (486) In short, this tool is more effective in hindsight, explaining why certain balance of economy of force and mass worked for various generals in their own unique circumstances.

103. Sun Tzu, 91.

104. Clausewitz, 486.

105. Ibid., 119.

106. Ibid., 136.

107. Holley, 40.

108. Barry D. Watts, The Foundations of US Air Doctrine The Problem of Friction in War (Maxwell Air Force Base, AL: Air University Press, 1984), 44.

109. Mitchell, 235-237, and Maurer, Vol III, 51-53. Maurer reproduces a much more detailed set of Mitchell's plans on 87-101. These plans demonstrate excellent staff work and a high degree of coordination, both among the various air units and with their associated Armies. While the detailed listing of targets, coordinating instructions, and the like makes interesting reading, its length prevents inclusion in this document. Instead, the summary provides sufficient detail to demonstrate Mitchell's grasp of aviation employment principles.

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